

What is claimed is:

1. An isolated parasitic helminth nucleic acid sequence capable of hybridizing, under stringent conditions, to at least a portion of at least one *Dirofilaria immitis* nucleic acid sequence selected from the group consisting of *D. immitis* nucleic acid sequence p4 and *D. immitis* nucleic acid sequence p22U.

2. The isolated nucleic acid sequence of Claim 1, wherein said isolated nucleic acid sequence encodes a protein capable of selectively binding to at least one component of immune serum, said immune serum being capable of inhibiting helminth development.

3. The isolated nucleic acid sequence of Claim 2, wherein said immune serum is derived from an animal that is essentially immune to infection by said helminth.

4. The isolated nucleic acid sequence of Claim 2, wherein said immune serum is derived from an animal immunized with a composition comprising parasitic helminth larvae selected from the group consisting of third stage larvae, fourth stage larvae, and mixtures thereof.

5. The isolated nucleic acid sequence of Claim 1, wherein said parasitic helminth is selected from the group consisting of nematodes, cestodes and trematodes.

6. The isolated nucleic acid sequence of Claim 1, wherein said parasitic helminth comprises a nematode selected from the group consisting of filarial, ascarid, strongyle and trichostrongyle nematodes.

7. The isolated nucleic acid sequence of Claim 1,

wherein said parasitic helminth is selected from the group consisting of *Dirofilaria*, *Onchocerca*, *Brugia*, *Wuchereria*, *Loa*, *Acanthocheilonema*, *Dipetalonema*, *Setaria*, *Parafilaria* 5 and *Stephanofilaria* filarial nematodes.

8. The isolated nucleic acid sequence of Claim 1, wherein said parasitic helminth comprises a *Dirofilaria immitis* nematode.

9. The isolated nucleic acid sequence of Claim 1, wherein said *Dirofilaria immitis* nucleic acid sequence is selected from the group consisting of *D. immitis* nucleic acid sequence p4, a nucleic acid sequence including *D. immitis* p4, 5 a nucleic acid sequence comprising a fragment of *D. immitis* p4, *D. immitis* nucleic acid sequence p22U, a nucleic acid sequence including *D. immitis* p22U and a nucleic acid sequence comprising a fragment of *D. immitis* p22U.

10. The isolated nucleic acid sequence of Claim 1, wherein said *Dirofilaria immitis* nucleic acid sequence is selected from the group consisting of SEQ ID NO:1, or a functional equivalent thereof, a nucleic acid sequence 5 containing at least a portion of SEQ ID NO:1 or a functional equivalent thereof, a fragment of SEQ ID NO:1 or a functional equivalent thereof, SEQ ID NO:3 or a functional equivalent thereof, a nucleic acid sequence containing at least a portion of SEQ ID NO:3 or a 10 functional equivalent thereof, and a fragment of SEQ ID NO:3 or a functional equivalent thereof.

11. The isolated nucleic acid sequence of Claim 1,

wherein said isolated nucleic acid sequence comprises an oligonucleotide capable of hybridizing to said *Dirofilaria immitis* nucleic acid sequence under stringent hybridization conditions.

12. The isolated nucleic acid sequence of Claim 1, wherein said isolated nucleic acid sequence, when administered to an animal in an effective manner, is capable of protecting said animal from infection by said helminth.

13. The isolated nucleic acid sequence of Claim 1, wherein said isolated nucleic acid sequence encodes a protein that, when administered to an animal in an effective manner, is capable of protecting said animal from infection by said helminth.

14. The isolated nucleic acid sequence of Claim 1, wherein said isolated nucleic acid sequence is obtained by a method comprising:

(a) culturing a parasitic helminth expression library under conditions that promote production of proteins encoded by said library;

(b) contacting said library with said immune serum under selective binding conditions; and

(c) selecting a colony or phage plaque that contains a nucleic acid sequence encoding a protein capable of selectively binding to said immune serum.

15. A recombinant molecule comprising at least one isolated nucleic acid sequence set forth in Claim 1 operatively linked to at least one transcription control

sequence.

16. A recombinant cell comprising a cell transformed with at least one isolated nucleic acid sequence set forth in Claim 1 operatively linked to at least one transcription control sequence.

17. A recombinant cell comprising a cell transformed with at least one isolated nucleic acid sequence set forth in Claim 1 in a manner such that said recombinant cell is capable of expressing said isolated nucleic acid sequence.

18. An isolated parasitic helminth protein, or mimetope thereof, capable of selectively binding to at least one component of immune serum that is capable of inhibiting helminth development, said protein being encoded by a parasitic helminth nucleic acid sequence capable of hybridizing, under stringent conditions, to at least a portion of at least one *Dirofilaria immitis* nucleic acid sequence selected from the group consisting of *D. immitis* nucleic acid sequence p4 and *D. immitis* nucleic acid sequence p22U.

19. The protein of Claim 18, wherein said immune serum is derived from an animal that is essentially immune to infection by said helminth.

20. The protein of Claim 18, wherein said immune serum is derived from an animal immunized with a composition comprising parasitic helminth larvae selected from the group consisting of third stage larvae, fourth stage larvae, and mixtures thereof.

21. The protein of Claim 18, wherein said parasitic helminth nucleic acid sequence is selected from the group consisting of *D. immitis* nucleic acid sequence p4, a nucleic acid sequence including *D. immitis* p4, a nucleic acid sequence comprising a fragment of *D. immitis* p4, *D. immitis* nucleic acid sequence p22U, a nucleic acid sequence including *D. immitis* p22U, and a nucleic acid sequence comprising a fragment of *D. immitis* p22U.

22. The protein of Claim 18, wherein said protein is encoded by a parasitic helminth nucleic acid sequence

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selected from the group consisting of SEQ ID NO:1, or a
functional equivalent thereof, a nucleic acid sequence
5 containing at least a portion of SEQ ID NO:1 or a
functional equivalent thereof, a fragment of SEQ ID NO:1 or
a functional equivalent thereof, SEQ ID NO:3 or a
functional equivalent thereof, a nucleic acid sequence
containing at least a portion of SEQ ID NO:3 or a
10 functional equivalent thereof, and a fragment of SEQ ID
NO:3 or a functional equivalent thereof.

23. The protein of Claim 18, wherein said protein
comprises at least a portion of an amino acid sequence
selected from the group consisting of SEQ ID NO:2 or
functional equivalent thereof and SEQ ID NO:4 or functional
5 equivalent thereof.

24. The protein of Claim 18, wherein said protein
being encoded by a parasitic helminth nucleic acid sequence
capable of hybridizing, under stringent conditions, to at
least a portion of *D. immitis* nucleic acid sequence p4
5 comprises a parasitic helminth LDD receptor-related protein
class A cysteine-rich motif.

25. The protein of Claim 24, wherein said motif
comprises DDCGDGSDE.

26. The protein of Claim 18, wherein said protein or
mimotope thereof, when administered to an animal in an
effective manner, is capable of protecting said animal from
infection by said helminth.

27. The protein of Claim 18, wherein said protein or mimetope thereof is capable of protecting an animal from heartworm infection.

28. An antibody capable of selectively binding to a parasitic helminth protein or mimotope thereof, said antibody being produced by a method comprising administering to an animal an effective amount of an isolated protein or mimotope thereof to produce said antibody, said protein being capable of selectively binding to at least one component of immune serum that is capable of inhibiting helminth development, and said protein being encoded by a parasitic helminth nucleic acid sequence capable of hybridizing, under stringent conditions, to at least a portion of at least one *Dirofilaria immitis* nucleic acid sequence selected from the group consisting of *D. immitis* nucleic acid sequence p4 and *D. immitis* nucleic acid sequence p22U.

29. The antibody of Claim 28, wherein said antibody, when administered to an animal in an effective manner, is capable of protecting said animal from infection by said helminth.

30.

A therapeutic composition capable of protecting an animal from parasitic helminth infection when administered to said animal in an effective manner, said composition comprising at least one protective compound selected from the group consisting of an isolated nucleic acid sequence capable of hybridizing, under stringent conditions, to at least a portion of at least one *Dirofilaria immitis* nucleic acid sequence selected from the group consisting of *D. immitis* nucleic acid sequence p4 and *D. immitis* nucleic acid sequence p22U; an isolated protein, or mimetope thereof, capable of selectively binding to at least one component of immune serum capable of inhibiting helminth development, said protein being encoded by said isolated nucleic acid sequence; and an antibody capable of selectively binding to a parasitic helminth protein or mimetope thereof, said antibody being produced by a method comprising administering to an animal an effective amount of said isolated protein or mimetope thereof to produce said antibody.

31. The composition of Claim 30, wherein said composition further comprises at least one component selected from the group consisting of an excipient, an adjuvant and a carrier.

32. The composition of Claim 30, wherein said composition comprises at least one of said protein or mimetope thereof and at least one *Dirofilaria* protein or functional equivalent thereof, said *Dirofilaria* protein being selected from the group consisting of P39, P22L,

P20.5, Di22, and larval proteases.

33. The composition of Claim 30, wherein said antibody further comprises a cytotoxic agent conjugated to said antibody.

34. The composition of Claim 30, wherein said isolated nucleic acid sequence is delivered to said cell by direct injection of said isolated nucleic acid sequence or by a vehicle selected from the group consisting of recombinant virus particle vaccines and recombinant cell vaccines.

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35.

A method to protect an animal from infection by a parasitic helminth comprising administering to said animal in an effective manner a therapeutic composition comprising at least one protective compound selected from the group consisting of an isolated nucleic acid sequence capable of hybridizing, under stringent conditions, to at least a portion of at least one *Dirofilaria immitis* nucleic acid sequence selected from the group consisting of *D. immitis* nucleic acid sequence p4 and *D. immitis* nucleic acid sequence p22U; an isolated protein, or mimetope thereof, capable of selectively binding to at least one component of immune serum capable of inhibiting helminth development, said protein being encoded by said isolated nucleic acid sequence; and an antibody capable of selectively binding to a parasitic helminth protein or mimetope thereof, said antibody being produced by a method comprising administering to an animal an effective amount of said isolated protein or mimetope thereof to produce said antibody.

36. The method of Claim 35, wherein said composition comprises a recombinant virus particle vaccine or a recombinant cell vaccine.

37. A method to produce an isolated parasitic helminth protein comprising culturing in an effective medium a cell capable of expressing said protein, said protein being encoded by a parasitic helminth nucleic acid sequence capable of hybridizing, under stringent conditions, to at least a portion of at least one *Dirofilaria immitis* nucleic acid sequence selected from the group consisting of *D. immitis* nucleic acid sequence p4 and *D. immitis* nucleic acid sequence p22U.

38. A method to produce an antibody capable of selectively binding to a protein or mimotope thereof, said method comprising administering to an animal an effective amount of an isolated protein or mimotope thereof to produce said antibody, wherein said protein is capable of selectively binding to at least one component of immune serum that is capable of inhibiting helminth development, and wherein said protein is encoded by an isolated parasitic helminth nucleic acid sequence capable of hybridizing, under stringent conditions, to at least a portion of at least one *Dirofilaria immitis* nucleic acid sequence selected from the group consisting of *D. immitis* nucleic acid sequence p4 and *D. immitis* nucleic acid sequence p22U.

39. A therapeutic composition capable of protecting an animal from parasitic helminth infection when administered to said animal in an effective manner, said composition comprising a compound capable of substantially interfering with the function of a parasitic helminth LDL receptor-related protein class A cysteine-rich motif.

40. The composition of Claim 39, wherein said function comprises sterol uptake.

41. The composition of Claim 39, wherein said therapeutic composition comprises a protein encoded by an isolated nucleic acid sequence capable of hybridizing, under stringent conditions, to at least a portion of 5 *Dirofilaria immitis* nucleic acid sequence p4.

42. A method to protect animals from parasitic helminth infection comprising administering to said animal in an effective manner the therapeutic composition set forth in Claim 39.

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